The Effect of Two Modes of Computer Assisted Instruction on Students' Achievement in Simultaneous Linear Equation in Kebbi State

Sufiyanu Haliru Jega
Department of Science Education,
Kebbi State University of science and Technology,
Aleiro
Email: abuhaliru@gmail.com

Mustapha Abubakar Giro
Department of Computer Science
Kebbi State University of Science and Technology,
Aleiro

Abstract
This study compared the effectiveness of two modes of computer assisted instruction on students' achievement in simultaneous equation. The study was carried out in Jega Education Zone of Kebbi State. A sample of two hundred and seventy one (271) students made up of one hundred and thirty two (132) male students and one hundred and thirty nine (139) female students were randomly selected from the schools that have computers in the zone. One intact class was selected from six (6) schools, three schools for boys and three for girls. One class from each school was used as experimental group I, II and control group making of two intact classes for each group. The design of this study was quasi-experimental. Three (3) research questions and three (3) hypotheses guided this study. The instrument used for data collection was simultaneous equation achievement test (SEAT) for pretest and post-test. The reliability coefficient of the simultaneous achievement test (SEAT) was calculated at value 0.91 using Kuder-Richardson (KR-20) formula. The three research question was answered using mean and standard deviation, and three hypotheses was tested using analysis of covariate (ANCOVA). The results of data analysis of this study shows that the mean achievement scores of students taught with computer (37.80 for drill and practice, and 50.62 for tutorial) were significantly higher than the mean achievement scores of students who were taught without computer (27.10).The effectiveness of computer in teaching mathematics depends on the mode of usage. Since the use of computer as Tutorial enhanced achievement in mathematics, the researchers therefore, recommended that mathematics teachers should use it as one of the strategies to be employed in teaching mathematics.

Keywords: *Computer, achievement, effects, mathematics, simultaneous equation*

Introduction

Mathematics has all through the years been an important subject both in the role it plays in everyday activities and in its usefulness to other sciences. Mathematics is a body of knowledge centered on concepts such as quantity, structure, space, change and also the academic discipline that studies them (Pierce, 2007). Mathematics is further defined by Pierce as the science that draws necessary conclusions. Other practitioners of mathematics such as Sowmya (2005), maintains that Mathematics is a science of pattern and highly needed in everyday life. According to Agwagah (2008), Mathematics is the study of numbers,

shapes, quantity, structure, and change or describe things(Macmillan Dictionary,2007).Carl Friedrich Gauss (1777-1855) known as the "Prince of Mathematicians" also refers to Mathematics as "the Queen of the Sciences" and the bedrock of other sciences. These definitions emphasize the importance of Mathematics.

Mathematics is widely used throughout the world, in human life and many fields including social sciences, Natural Sciences, Engineering, Medicine and Education. It is a vital tool in science, commerce and technology. According to Iji (2007), Mathematics provides an important key to understanding of the world. In the areas of buying and selling, communication, timing, measurement, molding, recording among others, the importance is highly acknowledged. Mathematics is one of the core subjects in both junior and senior secondary school curricula in Nigeria, which justifies its recognition as being essential in the development of technological advancement in Nigeria. The Federal Government of Nigeria made Mathematics compulsory and one of the core subjects in both primary and secondary schools because of its usefulness (FGN, 2004). Some of the roles of Mathematics according to Nurudeen (2007), includes: its ability to enhance the thinking capabilities of individuals by making them to be more creative, reasonable, rational as well as imaginative. There is no school curriculum or a national development planning which does not take cognizance of the usefulness and development in school mathematics.

Harbor-Peter (1999) was of the opinion that poor method of teaching and lack of basic knowledge are responsible for the observed poor performance of students in secondary school mathematics. Michael (2002) also noted that poor textbooks and lack of Computer technology in schools are also responsible for poor performance of students in mathematics. Mansil and Wiln (1998) are of the opinion that lack of knowledge and unavailability of computers are responsible for poor performance of students in mathematics. They suggested that teachers be sent on in-service training and retraining so as to meet up with the technological challenges in the society and also improve students' achievement in mathematics.

The attempt to take care of poor achievement of students in mathematics inspired some researchers to use computer technology in the classroom. Such researchers include: Mansil and Wiln (1998), Odogwu (1999), Ifeakor (2005), Ezeh (2009) and Pramila and Harsha (2012). Mansil and Wiln (1998) observed that learners are happier when they engage in mathematics with a sense of personal accessibility, coalescence and application rather than just a body of knowledge and skill. Odogwu (1999) in his own view noted that the computer in teaching creates room for self-checking and that the visual pictures enhance visualization and sensory perception.

Statement of the Problem

Poor achievement of students and lack of retention in mathematics is a known fact and of great concern to educators, researchers and mathematicians. Researchers are making great effort to see if there will be improvement on students' achievement in mathematics by adopting various methods of teaching mathematics. Their aim of using various methods is because poor method of teaching mathematics has been identified as one of the reasons for poor achievement of students in mathematics. There are problems associated with solving simultaneous equations like unable to find unknowns, incorrect value of constants, and finally the abstract nature of simultaneous equation that brings confusion to simultaneous expressions. It is in an attempt to remedy the situation that made researchers to suggest the

use of methods like – inquiry method, delayed formalization, expository, laboratory and computer in teaching simultaneous equation and other areas of mathematics. The use of computer in teaching could be as a tutorial, drill and practice simulation or tutee. These modes have been identified as the various modes of using computer in teaching mathematics(Usman,2002), but the mode that is more effective in teaching and learning of mathematics especially simultaneous equation is yet to be ascertained which calls for this study.

Purpose of the Study

The purpose of this study was to compare the effectiveness of computer as drill and practice, and as tutorial on students' achievement in Simultaneous Equation. Specifically to:

1. Compare the effectiveness of using computer and not using computer in learning simultaneous equation.
2. Compare the effectiveness of using computer as drill and practice, and as tutorial in learning simultaneous equation.
3. Ascertain whether the modes have any effect on male and female students' achievement in simultaneous equation.

Research Questions

1. What are the mean achievement scores of students who were taught with computer and those who were taught without computer?
2. What are the mean achievement scores of students who were taught with computer as drill and practice, and those who were taught with computer as tutorial?
3. What are the mean achievement scores of male and female students who were taught with computer as drill and practice, and those who were taught with computer as tutorial?

Research Hypotheses

HO_1: There is no significant difference between the mean achievement scores of students who were taught with computer and those who were taught without computer.

HO_2: There is no significant difference between the mean achievement scores of students who were taught with computer as drill and practice, and those who were taught with computer as tutorial.

HO_3: There is no significant difference between the mean achievement scores of male and female students' who were taught with computer as drill and practice, and those who were taught with computer as tutorial.

Research Methods

Research Design

The design of this study is Non-randomized Pretest-Posttest research design (quasi-experimental Design). The quasi experimental design according to Kerlinger (1970) as cited in Cohen et al (2007) refers to quasi-experimental situations as 'compromise designs', an apt description when applied to much educational research where the random selection or random assignment of schools and classroom or subjects is quite impracticable. The quasi-experimental is chosen because it controls the interval validity threats of the initial group equivalence and researcher's selection bias, since there is no randomization of the subjects into groups. Intact classes, which were already organized in normal school setting was used.

This will not disrupt the school setting in terms of classroom schedules, and so accommodated the study.

Area of the Study

The study was carried out in Jega Education zone of Kebbi State. The Zone is made up of four Local Government Areas; Jega, Aliero, Maiyama and Suru. In this education zone the total number of secondary schools is 63. 30 out of these schools are Senior Secondary Schools while 33 are Junior Secondary Schools. The schools with computer facilities and electricity were purposively selected for this study.

Population of the Study

The population for the study is all the Senior Secondary Two (SS II) students in Jega Education zone. That is the entire Senior Secondary Two (SS II) students in 30 Senior Secondary Schools in the zone.

Sample and Sampling Technique

The sample for this study was drawn from six schools. The schools with computer and electricity facility were purposively selected for this study. There is going to be three schools for boys and three for girls. The researcher selected one class from each school making a total of 6 intact classes. Only SS II students will be select. The three boys' schools and three girls' schools was assigned to experimental group I, II and the control group using simple random sampling technique.

Instrument for Data Collection

The instrument used for data collection was Simultaneous Equation Achievement Test (SEAT). This instrument was development by researcher using the table of specification which can be seen in appendix A. There were 20 multiple choice items covering the four methods of solving simultaneous equation. Out of the 20 questions, 12 were of higher order while 8 were of lower order. One test will be use for pretest, post-test test.

Validity of Instrument

Test blueprint and test items were subjected to content and face validity.

The instrument was equally subjected to content validation where the researcher check if the items covered the content./unit to be taught, the objectives of the lesson to be covered and whether the items are suitable for the level of the students to be taught. The item difficulty and discriminate index was calculated after the pilot study (Pilot testing) of the instrument (SEAT).

Reliability of Instrument

There was a trial testing (Pilot testing) of simultaneous Equation Achievement Test (SEAT) to estimate the internal consistency and stability of the instrument. The researcher was administered the instrument to SS II students in a school in Birnin-Kebbi Education Zone which is outside the Education Zone selected for the study. The internal consistency was computed using Kuder-Richardson formula (K-R 20) which was 0.91.

Experimental Procedure

One class in each school will assign to experimental group I, II or control group; making a total of two classes for each of the groups.

Table 1: Classes used for the Study

Schools	**Exp. I**	**Exp. II**	**Control**
Boys	1	1	1
Girls	1	1	1
Total	**2**	**2**	**2**

Experimental Group I (Computer as Drill and Practice)

For this group, the teacher was given an overview of simultaneous Equation and what the students are expected to learn. Those in Experimental group I will be taken to computer room where they were given Computer Algebra Application software on simultaneous Equation. The software will allow students to practice how to solve simultaneous equation. It adopts a "learning-by-doing" approach where students will follow the step-by-step instructions; answer questions and will be assessing by the computer. What students need to do is to use computer keyboard to insert the coefficient of the unknowns(x and y) and click solve, in few seconds computer will give solution to the problem.

Experimental Group II (Computer as Tutorial)

Those in experimental group II was taken to computer room where the teacher after teaching them demonstrate with the Intelligent Tutoring Application Software(ITAS) software to show how computer can solve simultaneous equations. This software (ITAS) is capable of solving any simultaneous linear equation problems. It will give a tutorial to students just like human tutor.

Control Group (Not use Computer)

In this group, computer was not used to teach simultaneous equation to students, rather traditional method of teaching was used, by using talk and chalk method (conventional method).

Control of the Effect of Pre-test on Post-test

The period between the pre-test and post-test was six weeks. This period is long enough to disallow the pre-test from affecting the post-test.

Variables of the Study

This study consists of two variables namely:

i) Dependent variable: The dependent variable is students' achievement in simultaneous equation.

ii) Independent variables: these are two modes of computer assisted instruction, Drill and practice, and Tutorial

Results

Research Question 1

What are the mean achievement scores of students who were taught with computer and those who were taught without computer?

Table 2: Mean Achievement Scores and Standard Deviation of Students who were taught with computer and without Computer.

		Pre-Test	Post-Test	Mean Gain
Drill & Practice Group	N	90	90	
	Mean	18.422	37.80	19.37
	S.D.	6.32	9.4	
Control	N	87	87	
	Mean	18.84	27.10	8.26
	Std. Deviation	6.90	8.72	
Tutorial	N	94	94	
	Mean	18.23	50.62	
	Std. Deviation	6.64	1.09	
Total	N	271	271	
	Mean	18.49	38.81	
	Std. Deviation	6.60	1.37	

Table 2 shows the mean achievement scores and standard deviation of students who were taught with Drill and Practice and Tutorial and those who were taught without computers students who were taught with as Drill and Practice had a mean of 37.8 in the post-test and standard deviation of 9.4 in the post-test and standard deviation of 9.4. Students who were taught with computer as Tutorial had a mean of 50.62 and standard deviation of 1.09 while students who were taught without computer had a mean of 27.10 and standard deviation of 8.72. This indicates that the students were at the same level before the experiment.

Research Question 2

What are the mean achievement scores of students who were taught with computer as Drill and Practice and those who were taught with computer as Tutorial?

Table 3: Mean Achievement Scores and Standard Deviation of Students Taught with computer as Drill/Practiced and Tutorial.

Modes/Groups		Pre-Test	Post-Test	Mean Gain
Drill & Practice Group	N	90	90	
	Mean	18.42	37.8	19.37
	S.D.	6.32	9.4	
Tutorial	N	94	9.4	
	Mean	18.23	50.62	32.39
	Std. Deviation	6.64	1.09	

Table 3 reveals that the mean achievement score of students taught with computer as Drill and Practice was 37.8 in the post-test with standard deviation of 9.4 while the mean achievement score of students taught with computer as Tutorial was 50.62 with standard deviation of 1.09. This indicates that student who was taught with computer as Tutorial achieved higher than students taught with computer as Drill/Practice.

Research Question 3

What are the mean achievement scores of male and female students who were taught with computer and those who were taught without computer?

Table 4: Mean Achievement Scores and Standard Deviation of Male and Female Students who were taught with Computer and without Computer?

Groups	Sex		Pre-Test	Post-Test
Drill & Practice Group	Male	N	40	40
		Mean	16.90	40.05
		Std. Deviation	6.56	1.03
	Female	N	50	50
		Mean	19.64	36.0
		Std. Deviation	5.91	8.39
	Total	N	90	90
		Mean	18.42	37.80
		Std. Deviation	6.32	9.4
Control	Male	N	42	42
		Mean	18.40	27.83
		Std. Deviation	7.84	9.00
	Female	N	45	45
		Mean	19.24	26.42
		Std. Deviation	5.94	8.48
	Total	N	87	87
		Mean	18.84	27.10
		Std. Deviation	6.90	8.72
Tutorial	Male	N	50	50
		Mean	17.84	51.34
		Std. Deviation	7.15	9.78
	Female	N	44	44
		Mean	18.68	49.79
		Std. Deviation	6.06	1.22
	Total	N	94	94
		Mean	18.23	50.62
		Std. Deviation	6.64	1.09

Table 4 shows the mean achievement scores and standard deviation of male and female students who were taught with computer both as Drill and Practice and as Tutorial and also those that were taught without computer. For Drill and Practice group, male students had a mean of 40.05 with standard deviation of 1.03 while female students had a mean of 36.0 with standard deviation of 8.39 in the post-test. For Tutorial group, male students had a mean of 51.34 with standard deviation of 9.78 while female students had a mean of 26.42 with standard deviation of 8.48. This indicated that male students taught with computer both as Drill and Practice and tutorial achieved higher than male students who were taught without computer.

Research Hypothesis 1

HO_1: There is no significant difference between the mean achievement scores of students who were taught with computer and those who were taught without computer.

Table 5: ANCOVA Table of Students' Scores in the Simultaneous Equation Achievement Test (SEAT)

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Result
Corrected Model	26021.050[a]	6	4336.84	46.21	.000	S
Intercept	36894.217	1	36894.21	393.18	.000	S
Pretest	438.738	1	438.73	4.67	.031	S
Group	25051.040	2	12525.52	133.48	.000	S
Sex	456.915	1	456.91	4.86	.028	S
Group *Sex	128.280	2	128.28	.68	.506	NS
Error	24772.352	264	93.83			
Total	459016.000	271				
Corrected Total	50793.402	270				

S = Significant at 0.05 Probability level.
NS = Not Significant at 0.05 probability level.

Table 5 indicated that the use of computer in teaching simultaneous equation is a significant factor in the mean achievement scores of students who were taught with computer and without computer. This is because with the 95% confidence interval of different, the value of F, its degree of freedom and its p-value significant, the value of F is 46.2 and the result of the test is significant beyond the 0.05 level of significant as .000 is less than 0.05. Therefore the null hypothesis of no significant difference is hereby rejected. This means that there is a significant difference in the mean achievement scores of students taught with computer and those taught without computer.

Hypothesis 2

HO_2: There is no significant difference between the mean achievement scores of students who were taught with computer as Drill and Practice and those who were taught with computer as Tutorial.

Table 6: ANCOVA Table of Students who was taught with computer as Drill and Practice and as Tutorial on Achievement.

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Result
Corrected Model	7994.960[a]	4	1998.740	19.136	.000	S
Intercept	37469.739	1	37469.739	358.729	.000	S
Pretest	21.500	1	21.500	.206	.651	NS
Group	7173.694	1	7173.694	68.680	.000	S
Sex	374.368	1	374.368	3.584	.060	NS
Group *Sex	77.062	1	77.062	.738	.392.	NS
Error	18696.780	179	104.451			
Total	388570.0	184				
Corrected Total	26691.739	183				

S = Significant at 0.05 Probability Level.

NS = Not Significant at 0.05 probability Level.

Table 6 indicated that the mode of computer usage is a significant factor in the mean achievement scores of students in the simultaneous Equation Achievement Test (SEAT). This is because with the 95% confidence interval of difference, the value of f, it degree of freedom and its p-value significant, the value of F is 19.136 and the result of the test is significant beyond the 0.05 level of significant as 0.000 is less than 0.05. This hypothesis 2 of no significant difference in the mean achievement scores is therefore rejected. Hence the use of computer as Tutorial influenced achievement more than the use of computer as Drill and Practice.

Hypothesis 3

HO_3: There is no significant difference between the mean achievement scores of male students' who were taught with computer as Drill and Practice and those who were taught with computer as Tutorial.

Table 6 also indicated that sex is not a significant factor in the mean achievement scores of students who were taught with computer as Drill and practice and as Tutorial. This is because with the 95% confidence interval, the value of F, is 0.738 and the result of the test is not significant beyond the 0.05 level as 0.392 is greater than 0.05. This hypothesis 3 of no significant difference in the mean achievement scores is therefore accepted. This means that there is no significant difference in the mean achievement scores of male and female students taught with computer as Drill and Practice and as Tutorial.

Conclusion

The following conclusions are made based on the findings of this study. The results of this study provided the empirical evidence that the use of computer as Tutorial enhanced students' achievement in Simultaneous Equation more than the use of computer as Drill and practice. Thus the effectiveness of computer in teaching Mathematics depends on the mode of usage. More so, that the use of computer in teaching simultaneous equation is better than teaching simultaneous equation without computer.

Also, there was no significant difference between the mean achievement scores of male and female students that were taught with computer as Drill and Practice and as Tutorial in Simultaneous. Thus the computer did not recognize whether a male or a female student was using it. This implies that gender has no significant effect on achievement of students in the Simultaneous Equation Achievement Test (SEAT).

Recommendations

The following recommendations were made based on the findings of this study:

1. Since the use of computer as Tutorial enhanced achievement in Mathematics, the Mathematics teachers should use it as one of the strategies to be employed in teaching Mathematics in our schools.
2. Workshops/seminars should be organized by Government for Mathematics teachers to enable teachers learn how to use computer in teaching Mathematics.
3. Government and Non-Governmental Organizations (NGOs) should provide computers to schools so that every student will have access to computer.

4. Parents should equally encourage to buy computers for students to use at home after school hours. This will help students to practice what they have learnt in the school and equally discourage them from engaging in unnecessary activities after school.
5. Computer programmers and software developers should be encouraged to use mathematics curriculum in the production of software and arranged them according to classes for teaching and learning mathematics.

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